SECTION 02270

SLOPE PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Included: This Section specifies the following types of slope protection.

1. Type 1, Dumped Riprap: angular shaped stones dumped in place to form a well-graded mass with a minimum of voids.
2. Type 2, Slope Paving: angular shaped stones, each having one flat face, carefully placed on slopes.
3. Type 3, Special Slope Paving under Bridges:
   a. Type 3A: Quarry stone, not grouted.
   b. Type 3B: Quarry stone, grouted.
   c. Type 3C: Precast concrete block.
   d. Type 3D: Portland cement concrete.
4. Type 4, Channel Paving: Nearly rectangular stones placed along the slopes around culvert inlets or outlets, around foundations, bridge berms and dikes.
   a. Type 4A: not grouted.
   b. Type 4B: grouted.

B. Alternates: Not Applicable.

C. Items to Be Installed Only: Not Applicable.

D. Items to Be Furnished Only: Not Applicable.

E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 02300 - Earthwork
2. Section 03300 - CAST-IN-PLACE CONCRETE.

Article I. REFERENCES

A. American Society for Testing and Materials, ASTM C-139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes

B. American Society for Testing and Materials, ASTM C-140, Standard Test Methods for Sampling and Testing.

1.2 QUALITY ASSURANCE

A. Control of gradation of stone for Type 1 slope protection shall be by visual inspection. Provide at the construction site and at the quarry a mass of rock of at least five tons meeting the specified gradation. The sample at the construction site may be a part of the finished riprap covering. These samples will be used as a reference for judging the gradation of riprap supplied.

B. JOB CONDITIONS

1. Do not grout slope or channel paving or place concrete slope paving on

frozen ground nor when the temperature falls below 50 degree F. During cold weather, provide protective coverings for the work.

2. Should any work be exposed to temperatures of 40 degrees F or below, within four days after grouting or concrete placement, cover the work with a one-foot thick layer of straw, hay or mulch; then cover with a weighted cover of canvas or plastic sheet.

Article II. PART 2 - PRODUCTS

2.1 TYPE 1, DUMPED RIPRAP

A. Stone: hard, durable, angular in shape; resistant to weathering; free from overburden, spoil, shale and organic materials; neither breadth nor thickness of a stone shall be less than one third its length.

B. Gradation

1.

SIZE OF STONE SMALLER THAN GIVEN SIZE	MAXIMUM PERCENT OF TOTAL WEIGHT
400 pounds	100
300 pounds	80
200 pounds	50
25 pounds	10

2. Maximum percent passing a two-inch sieve: 5 percent

2.2 TYPE 2, SLOPE PAVING

A. Stone: sound, angular in shape, free from structural defects; each stone having one reasonably flat face, a thickness perpendicular to the face of not less than six inches and no dimension less than six inches.

B. Gradation: approximately 60 percent, two to three cubic feet each in volume; the remainder, one to two cubic feet each in volume.

2.3 TYPE 3, SPECIAL SLOPE PAVING UNDER BRIDGES

A. Quarry Stone: granite or other similar durable stone; rectangular exposed surface with split or quarry face finish; uniform in color; 12 to 28 inches long, 10 to 14 inches wide, 3 to 6 inches thick.

B. Precast Concrete Block: ASTM C-139, 4 inches by 12 inches by 16 inches, sampled and tested in accordance with ASTM C-140.

C. Grout: Portland cement, sand and water mixture with a minimum 28 day compressive strength of 3,000 psi.

D. Concrete: Section 03310, Class 3000 - 1-1/2.

2.4 TYPE 4, CHANNEL PAVING

A. Stone: sound, durable, angular blocks, as nearly rectangular as practicable; rounded stones or thin slabs will not be acceptable.

B. Gradation: minimum 75 percent, at least 200 pounds; the remainder graded to produce a compact mass when placed with the larger stones.

C. Grout: As specified in paragraph 2.03.C above.

2. 5 GRAVEL BORROW OR CRUSHED STONE BASE: Section 02300 - EARTHWORK.

PART 3 - EXECUTION

3.1 TYPE 1, DUMPED RIPRAP

A. Place stone on the prepared slope or area in such a manner as to produce a well-graded mass of stone with the minimum practicable percentage of voids and a minimum thickness of two feet. Place stone to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing of stone in layers or by dumping into chutes or by similar methods likely to cause segregation will not be permitted. Place and rearrange stones by hand or by mechanical equipment as necessary to produce a compact riprap protection in which all sizes of stones are placed in their proper proportions.

B. Place riprap in conjunction with the construction of the embankment with only sufficient lag in construction of the riprap protection to allow for proper construction of the embankment and to prevent mixture of embankment and riprap material. Maintain the elevation of the riprap within two feet of the elevation of the embankment during construction.

3.2 TYPE 2, SLOPE PAVING. Place stones on an approved base of gravel borrow, crushed stone or other acceptable material to the lines and grades indicated. Placed the larger stones closely together throughout the surface and chink the interstices carefully with the smaller stones. Securely bed all stones with the exposed surfaces approximately parallel to and within six inches of the slope shown on the plans.

3.3 TYPE 3, SPECIAL SLOPE PAVING UNDER BRIDGES

A. General: Place special slope paving under bridges on a six-inch gravel borrow or crushed stone base. Construct the paving to a continuous surface of uniform appearance, approximately parallel to and within three inches of the slope shown on the plans.

B. Type 3A, Quarry Stone, not Grouted: Lay the paving in uniform courses with broken joints not exceeding two inches in width. Fill the joints with sand or a sand/gravel mixture.

C. Type 3B, Quarry Stone, Grouted and Type 3C, Precast Concrete Block: Lay the paving in uniform courses with broken joints not exceeding two inches in width. Fill the joints with sand or fine gravelly material to within two inches of the paved surface; then fill the joints with grout to the top of the paved surface. After grouting is completed, quarry stone shall be covered and kept wet for five days.

D. Type 3D, Portland Cement Concrete: Section 03300 CAST-IN-PLACE CONCRETE.

3.4 TYPE 4, CHANNELING PAVING. Place stones on an approved gravel borrow or crushed stone base. Place the larger stones as closely together as possible throughout the surface. Securely bed all stones so that the exposed surfaces will be approximately parallel to and within three inches of the grade shown on the plans. Soak stones to provide a saturated surface dry condition prior to placing grout. Place grout after the paving is completely in place. Sprinkle the stone with water immediately before placing grout.

Article III. PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Type 1 Slope Protection will be measured by the ton.

B. Type 2, 3 and 4 Slope Protection will be measured by the square yard, including grout as applicable.

C. Gravel borrow or crushed stone base for slope protection will be measured as specified in Section 02300 - EARTHWORK.

D. Earthwork necessary for construction of slope protection will be measured as specified in Section 02300 - EARTHWORK.

4.2 PAYMENT

A. Slope Protection will be paid for at the Contract unit price for the quantities of each type measured as specified above.

B. Gravel borrow or crushed stone base for slope protection will be paid for as specified in Section 02300 - EARTHWORK.

C. Earthwork necessary for construction of slope protection will be paid for as specified in Section 02300 - EARTHWORK.

END OF SECTION